

# BMJ Open Secondhand smoke in outdoor settings: smokers' consumption, non-smokers' perceptions, and attitudes towards smoke-free legislation in Spain

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## ABSTRACT

**Objective:** To describe where smokers smoke outdoors, where non-smokers are exposed outdoors to secondhand smoke (SHS), and attitudes towards smoke-free outdoor areas after the implementation of national smoke-free legislation.

**Design:** This cross-sectional study was conducted between June 2011 and March 2012 (n=1307 participants).

**Setting:** Barcelona, Spain.

**Participants:** Representative, random sample of the adult (≥16 years) population.

**Primary and secondary outcomes:** Proportion of smoking and prevalence of exposure to SHS in the various settings according to type of enclosure. Percentages of support for outdoor smoke-free policies according to smoking status.

**Results:** Smokers reported smoking outdoors most in bars and restaurants (54.8%), followed by outdoor places at work (46.8%). According to non-smokers, outdoor SHS exposure was highest at home (42.5%) and in bars and restaurants (33.5%). Among non-smoking adult students, 90% claimed exposure to SHS on university campuses. There was great support for banning smoking in the majority of outdoor areas, which was stronger among non-smokers than smokers. Over 70% of participants supported smoke-free playgrounds, school and high school courtyards, and the grounds of healthcare centres.

**Conclusions:** Extending smoking bans to selected outdoor settings should be considered in further tobacco control interventions to protect non-smokers from SHS exposure and to establish a positive model for youth. The majority of public support for some outdoor smoke-free areas suggests that it is feasible to extend smoking bans to additional outdoor settings.

## INTRODUCTION

Smoke-free policies have been demonstrated to be an effective way to protect people from the adverse effects of secondhand smoke (SHS) exposure.<sup>1 2</sup> Such policies have been

## Strengths and limitations of this study

- This study is the first to describe together tobacco consumption, secondhand smoke exposure, and attitudes towards smoke-free policies in a number of outdoor settings, thus providing an overall picture of these related aspects of tobacco control.
- It included representative, random samples of the population of Barcelona (Spain).
- It included information obtained after the implementation of Spanish comprehensive smoke-free legislation (Law 42/2010). It would have been of great interest to have data before that law, and also before and after previous legislation (Law 28/2010) to evaluate possible changes.

successfully implemented in indoor public places and workplaces in several countries during the last decade, in accordance with Article 8 of the Framework Convention on Tobacco Control as recommended by the WHO.<sup>3</sup> Reported impacts of these smoke-free laws after their implementation include reductions in SHS exposure by 80–90% in high-exposure settings,<sup>4</sup> reductions in respiratory symptoms,<sup>5</sup> an immediate decrease in the incidence of heart attacks,<sup>6</sup> an increase in the number of smokers who want to quit,<sup>7</sup> the encouragement of smoke-free homes,<sup>8</sup> and even a neutral or positive effect on business in the hospitality sector and elsewhere.<sup>9</sup>

However, smoke-free policies in indoor work places and public places may motivate smokers to relocate to outdoor settings.<sup>10 11</sup> In recent years, several countries have extended smoke-free legislation to various outdoor settings, including healthcare centres, children's playgrounds, beaches, dining areas, sporting venues, public building entrances, transport settings, partly enclosed streets and university campuses.<sup>10 12 13</sup>

These policies are becoming popular and socially accepted, with public support increasing over time,<sup>14</sup> but they are not free of criticism.<sup>15–17</sup> Those who oppose outdoor smoke-free legislation claim that it is ethically unsustainable because it does not respect the principle of freedom and autonomy of individuals, and that there is insufficient evidence that SHS in these environments impacts health.<sup>15 16</sup> Supporters of these policies argue that outdoor smoking bans reduce the visibility of smoking, that they are associated with denormalisation of smoking, that they establish a positive smoke-free model for youth, and that they reduce smoking opportunities and SHS exposure. Furthermore, smoking bans may be accompanied by environmental benefits such as reducing fire risk and pollution from butts.<sup>14 16–21</sup>

On 2 January 2011, Spain implemented a new smoke-free law (Law 42/2010), the first time in Europe<sup>22</sup> that smoking was prohibited in some outdoor areas, including hospital premises, schools and high school courtyards, and children's playgrounds.<sup>23</sup> In this context, the objectives of the present study were to describe: (1) the outdoor settings in which smokers smoke, (2) the outdoor settings in which non-smokers are exposed to SHS, and (3) the attitudes towards smoke-free outdoor policies after implementation of Law 42/2010.

## METHODS

### Study design and selection of study participants

We conducted a cross-sectional study among the adult ( $\geq 16$  years) population of Barcelona, Spain. A representative, random sample by age, sex and district was drawn from the official 2010 population census of Barcelona, a reliable source of population based information. The survey was conducted between June 2011 and March 2012, after implementation of national, comprehensive smoke-free legislation (on 2 January 2011). A detailed description of the methods has been provided elsewhere.<sup>24</sup> In brief, we determined a sample size of 1560 people with standard procedures ( $\alpha$  error of 5%,  $\beta$  error of 20%, and 20% losses for independent samples); our final sample included 1307 individuals. Sample size calculations were performed with GRANMO MS Windows V.5.2 (<http://www.imim.es/media/upload/arxius/grmw52.zip>).

We obtained data and addresses for Barcelona residents from the updated official city census (year 2010) provided by the Municipal Institute of Statistics of Barcelona. Individuals aged 16 years and older were eligible to participate in this study. A letter was mailed to eligible individuals to describe the purpose of the study and to inform them that they had been selected at random. The letter also indicated that the study required a visit from an interviewer that would administer the questionnaire and collect a saliva sample. The individuals were informed that they were free to decline participation, and that they could access more information about the study on a website, by telephone or by

email; contact information was provided in the letter. Participants that could not be located after several attempts (at different times of day and different days of the week) and those that declined to participate in the study were replaced at random. Replacements were chosen from eligible individuals of the same sex, within a 5-year age group, and within the same district of residence. Substitutions accounted for 54.6% of the survey respondents.

Individuals that agreed to participate were interviewed at home by trained interviewers. Participants were asked to sign an informed consent form before proceeding with the face-to-face, computer-assisted interview. The questionnaire included information on sociodemographics, tobacco consumption, self-assessed exposure to SHS in various settings (at home, at work/educational venues, during leisure time, and in public and private transportation), and attitudes towards smoking restrictions. After completing the questionnaire, respondents were asked to provide a sample of saliva for cotinine analysis.

The Research and Ethics Committee of Bellvitge University Hospital approved the study protocols and the informed consent forms.

### Smokers' tobacco consumption in outdoor settings

Smokers were defined as individuals that, at the time of the interview, reported that they smoke at least one cigarette per day (daily smokers), that they smoke occasionally (occasional smokers), or that had a salivary cotinine concentration  $>10$  ng/mL.<sup>25</sup>

Settings where tobacco was consumed were determined with the same questions for home, work, bars/restaurants and discotheques/pubs. The question was, 'How many cigarettes (per day) do you normally smoke at (home/work/bars and restaurants/discotheques/pubs)?' Based on this question, we established four categories of settings where tobacco was consumed: (1) places with no consumption, which included subjects who reported smoking cigarettes neither indoors nor outdoors; (2) places with tobacco consumption only indoors, which included individuals who reported smoking one or more cigarettes indoors only; (3) places with tobacco consumption only outdoors, which included individuals who reported smoking one or more cigarettes outdoors only; and (4) places with tobacco consumption both indoors and outdoors, which included individuals who reported smoking one or more cigarettes both indoors and outdoors.

### Non-smoker SHS exposure in outdoor settings

Non-smokers were defined as individuals who, at the time of the interview, reported that they did not smoke and had a salivary cotinine concentration  $\leq 10$  ng/mL.<sup>25</sup> This group included individuals that had never smoked as well as former smokers.

Exposure to SHS was evaluated with different questions depending on the setting studied. We determined

exposure at home, at work, at education venues (including the following places: classroom, corridor or hall, bar or cafeteria, study room, photocopying room, main building entrances (outdoors), and other outdoor locations on campus), during leisure time (including bars, restaurants, discotheques and pubs), on public transportation (including subway or tram, subway or tram station, train, train station, bus and bus station). Based on the responses regarding SHS exposure in those settings, we established four categories of SHS exposure for each setting: (1) non-exposed individuals, which included individuals with no exposure according to their answers; (2) individuals exposed only indoors, which included individuals who declared that they were only exposed in some of the indoor places; (3) individuals exposed only outdoors, which included individuals who reported that they were only exposed in some of the outdoor places; and (4) individuals exposed both indoors and outdoors, which included individuals who reported exposure in any of the indoor and outdoor places.

### Public support for outdoor smoke-free policies

We included information about public support for outdoor smoke-free policies from smokers and non-smokers. Public support for outdoor smoke-free policies was determined using the question, 'To what extent do you agree or disagree with the prohibition of smoking in the following outdoor settings?' Five responses were possible (totally agree, agree, neither agree nor disagree, disagree, totally disagree). We recorded information about outdoor locations in schools/high schools, university campuses, healthcare centres, public transportation, playgrounds, shopping centres, sport centres, and swimming pools and beaches. For the analysis, we derived a variable for each setting with three categories: (1) 'Agree', which included individuals who reported total agreement or agreement with implementing outdoor smoke-free legislation; (2) 'Neither agree nor disagree', which included subjects who described themselves as neither in favour nor against the prohibition of smoking outdoors; and (3) 'Disagree', which included individuals who disagreed or totally disagreed with implementing outdoor smoke-free legislation.

### Statistical analysis

For smokers, we computed the proportion of smoking in the various settings according to type of enclosure. For non-smokers, we computed the prevalence of exposure to SHS in various settings and according to the type of enclosure. We also computed percentages of support for outdoor smoke-free policies according to smoking status. Analyses were stratified by sex, age (16–44, 45–64 and ≥65 years) and educational level (less than primary and primary school, secondary school, and university). The data were fitted with multivariate log-binomial models to assess the prevalence ratios (PR) and 95% CI of public support for outdoor smoke-free policies in various settings. The models were adjusted for smoking

status, sex, age and educational level. Statistical analyses were performed with SPSS V.17.0 and STATA V.12.0.

## RESULTS

A total of 1307 participants were interviewed (615 male and 692 female); 947 participants were self-reported non-smokers (409 male and 538 female) and 360 were self-reported smokers (206 male and 154 female). Of the non-smokers, 19 had cotinine concentrations consistent with active smoking (>10 ng/mL) and thus were classified as smokers.<sup>25</sup> Of self-reported non-smokers, 48 did not provide a saliva sample and in two cases the cotinine analysis was not possible (ie, insufficient sample); these cases were considered missing data.

Table 1 shows the proportion of smokers who reported smoking outdoors in various settings. Nearly 18% of smokers reported that they smoked at home in outdoor areas alone, while 18.1% smoked both indoors and outdoors. Forty-six per cent of smokers said that they only smoked outdoors while at work. Smoking participants smoked outdoors most often in bars and restaurants (54.8%), and outdoors in discotheques and pubs (34.6%).

At home, 42.5% of non-smokers reported SHS exposure only outdoors (18.8%) or both indoors and outdoors (23.7%). At work, SHS exposure in outdoor settings was self-reported by 15% of non-smokers; 83.7% of non-smokers claimed that they were not exposed to SHS in any setting during work. Most adult students interviewed were exposed to SHS in education venues outdoors only (70.2%) or both indoors and outdoors (20.2%). Non-smokers were exposed to SHS outdoors in bars and restaurants (33.5%) and outdoors in discotheques and pubs (14.4%). The rate of self-reported exposure outdoors on public transportation was 2.8% (table 2).

Table 3 presents the percentages and adjusted PRs with the corresponding 95% CI of support of the smoking ban in various outdoor settings after implementation of the new Spanish smoke-free legislation. Overall, 80.8% of participants supported smoke-free playgrounds, 71.8% grounds of healthcare centres, 70.5% school and high school courtyards, 56.1% public transportation outdoors, 53.5% sport centres outdoors, 52.7% university campuses, 43.0% open swimming pools and beaches, and 38.4% outdoor areas in shopping centres. The respective proportions of non-smokers who supported outdoor smoking bans were higher than these overall figures, but the respective proportions of agreement among smokers were 15–30 percentage points lower (table 3); these differences were statistically significant after controlling for sex, age and educational level. Similar patterns were observed for men and women in terms of the agreement on outdoor smoke-free policies. There was no specific pattern according to age and educational level.

## DISCUSSION

This is the first study to evaluate where smokers smoke outdoors, where non-smokers receive outdoor exposure

**Table 1** Distribution of 379 smokers ( $\geq 16$  years) according to where they smoke and type of enclosure; Barcelona, 2011–2012

	No consumption % (n)	Smoking only indoors % (n)	Smoking only outdoors % (n)	Smoking both indoors and outdoors % (n)
Home (n=360)	16.1 (58)	48.1 (173)	17.8 (64)	18.1 (65)
Work (n=250)	48.8 (122)	4.4 (11)	46.0 (115)	0.8 (2)
Bars and restaurants (n=338)	39.6 (134)	5.6 (19)	51.5 (174)	3.3 (11)
Discotheques and pubs (n=173)	63.0 (109)	2.3 (4)	32.9 (57)	1.7 (3)

to SHS, and attitudes towards smoke-free outdoor areas in Spain, and after the implementation of national, comprehensive smoke-free legislation.

### Where smokers smoke and where non-smokers are exposed to SHS outdoors

Our results reveal that both consumption and self-reported SHS exposure were very low, if not absent, in indoor settings regulated by national, comprehensive smoke-free legislation. However, non-smokers reported SHS exposure in most outdoor settings in which smokers reported smoking. These results suggest the relocation described in early observational studies<sup>10–11</sup> after implementation of smoke-free policies affecting indoor public places and workplaces.

In the present investigation, more smokers (49.2%) reported smoking in the outdoor areas of bars and restaurants. Accordingly, 33.5% of the non-smokers interviewed reported SHS exposure in those settings. In Spain, bars and restaurants were exempted from the smoking ban before Law 42/2010, and people could smoke indoors in some venues; the current smoke-free law prohibits smoking in those places with no exceptions. We cannot affirm that the prevalence of people smoking in those outdoor places have increased after the implementation of the smoking ban but, in a country like Spain, which has a popular culture of socialisation, it is understandable that smokers relocated to the outdoor areas of bars and restaurants. A recent study of the impact of the Spanish smoke-free law demonstrated that the presence of outdoor smoking may be reducing the effectiveness of the indoor smoking ban at protecting hospitality workers and patrons from SHS exposure.<sup>26</sup> A previous investigation of outdoor smoking behaviour before and after implementation of France's

national smoke-free law suggested that smokers relocated to outdoor environments based on an increase in reported smoking at hospitality venues, including both restaurants and cafés/pubs/bars.<sup>27</sup>

In the present study, self-reported exposure in outdoor areas at home constituted ~40% of positive responses. Moreover, 84% of smokers reported smoking at home, and 35.9% of them smoked in outdoor areas. Although recent studies of the effects of stepped smoke-free legislation (Laws 28/2005 and 42/2010) in Spain observed significant relative reductions (15.1%<sup>24</sup> and 43.1%<sup>28</sup>) in self-reported SHS exposure in the home, it is important to consider the results of the present investigation to focus new strategies on increasing the percentage of smoke-free homes.

Among non-smoking adult students, 90% reported SHS exposure on university campuses, higher than the 79.5% reported in a previous study of staff and students in an Australian university.<sup>29</sup> These differences likely indicate a more advanced stage of denormalisation and tobacco control achievements in those countries, where, in turn, the prevalence of smoking is lower than in Spain. In the same study, respondents supported a smoke-free policy on campus, and 65.7% of respondents felt that the campus should be completely smoke-free. Another investigation of university students in Beirut, Lebanon indicated that after establishing a smoke-free campus, most students were satisfied with the extension of the ban, and some smokers reduced smoking or declared that the ban could help them to quit.<sup>30</sup> In our study, 52.7% of respondents favoured smoke-free university campuses. Together with the high percentage of respondents exposed in this setting and the results of other studies, our investigation suggests the need to consider making university campuses smoke-free.

**Table 2** Secondhand smoke exposure among 878 non-smokers ( $\geq 16$  years) according to the setting of exposure and the type of enclosure; Barcelona 2011–2012

	Not exposed % (n)	Only indoors % (n)	Only outdoors % (n)	Both indoors and outdoors % (n)
Home (n=876)	50.7 (444)	6.7 (59)	18.8 (165)	23.7 (208)
Work (n=489)	83.7 (386)	1.3 (6)	15.0 (69)	—
Education venues (n=134)	9.7 (12)	—	70.2 (87)	20.2 (25)
Bars and restaurants (713)	64.2 (458)	2.2 (16)	32.8 (234)	0.7 (5)
Discotheques and pubs (n=297)	84.2 (250)	1.3 (4)	13.1 (39)	1.3 (4)
Public transport (n=724)	96.3 (644)	0.9 (6)	0.3 (2)	2.5 (17)



**Table 3** Agreement with the smoking ban in various outdoor settings n=1307 participants) according to smoking status, sex, age and educational level; Barcelona 2011–2012

	School/high school		University		Healthcare centres		Public transportation		Playgrounds		Shopping centres		Sport centres		Swimming pool/beach	
	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)	PR* (95% CI)	% (n)
All	70.5 (1302)	52.7 (1300)			71.8 (1301)	56.1 (1305)			80.8 (1301)	38.4 (1298)			53.5 (1289)		43.0 (1296)	
Smoking status																
Non-smokers	76.1 (874)	60.2 (874)	1 (874)	63.3 (877)	77.8 (873)	63.3 (877)	1 (877)	84.9 (876)	84.9 (876)	45.5 (870)	1 (866)	62.4 (866)	1 (866)	51.6 (868)	1 (868)	
Smokers	56.6 (378)	34.7 (377)	0.46 (0.37 to 0.56)	39.4 (378)	57.9 (378)	0.54 (0.46 to 0.64)	0.48 (0.40 to 0.58)	69.9 (375)	0.58 (0.49 to 0.68)	20.6 (378)	0.37 (0.29 to 0.47)	32.0 (375)	0.38 (0.31 to 0.46)	21.4 (378)	0.33 (0.26 to 0.42)	
Sex																
Men	70.1 (612)	52.8 (614)	1 (614)	56.6 (613)	71.8 (613)	56.6 (613)	1 (613)	80.9 (613)	80.9 (613)	40.1 (613)	1 (614)	54.6 (614)	1 (614)	41.2 (614)	1 (614)	
Women	70.9 (690)	52.6 (686)	0.89 (0.75 to 1.04)	55.6 (692)	71.8 (688)	0.94 (0.81 to 1.09)	0.93 (0.79 to 1.08)	80.7 (688)	0.94 (0.81 to 1.08)	36.8 (685)	0.79 (0.66 to 0.96)	52.6 (675)	0.82 (0.70 to 0.97)	44.6 (682)	0.98 (0.82 to 1.17)	
Age in years																
16–44	70.9 (595)	49.5 (594)	1 (594)	55.8 (595)	73.8 (596)	55.8 (595)	1 (595)	83.5 (594)	83.5 (594)	36.5 (595)	1 (593)	53.0 (593)	1 (593)	39.8 (593)	1 (593)	
45–65	66.5 (388)	49.2 (386)	0.88 (0.72 to 1.07)	54.1 (390)	65.5 (385)	0.72 (0.60 to 0.85)	0.87 (0.72 to 1.04)	77.4 (389)	0.75 (0.64 to 0.89)	34.5 (388)	0.81 (0.65 to 1.02)	49.7 (384)	0.78 (0.64 to 0.95)	41.4 (389)	0.93 (0.75 to 1.14)	
≥65	74.6 (319)	62.8 (320)	0.96 (0.77 to 1.20)	59.1 (320)	75.6 (320)	0.80 (0.65 to 0.98)	0.86 (0.69 to 1.06)	79.9 (318)	0.68 (0.55 to 0.83)	46.7 (315)	0.92 (0.71 to 1.18)	59.3 (312)	0.88 (0.70 to 1.10)	51.0 (314)	0.94 (0.74 to 1.19)	
Educational level																
Less than secondary	74.1 (348)	65.0 (349)	1 (349)	57.9 (349)	75.5 (347)	57.9 (349)	1 (349)	82.8 (348)	82.8 (348)	47.0 (347)	1 (345)	56.5 (345)	1 (345)	49.7 (344)	1 (344)	
Secondary	66.6 (521)	48.4 (519)	0.64 (0.52 to 0.79)	54.6 (522)	72.4 (522)	0.85 (0.70 to 1.03)	0.86 (0.70 to 1.06)	77.4 (518)	0.76 (0.63 to 0.92)	34.4 (520)	0.65 (0.51 to 0.83)	49.4 (516)	0.79 (0.64 to 0.98)	40.2 (520)	0.76 (0.60 to 0.95)	
University	72.2 (431)	47.9 (430)	0.62 (0.49 to 0.77)	56.5 (432)	67.9 (430)	0.74 (0.60 to 0.90)	0.92 (0.74 to 1.14)	83.1 (433)	0.87 (0.71 to 1.06)	35.9 (429)	0.70 (0.54 to 0.90)	55.9 (426)	0.92 (0.73 to 1.15)	40.9 (430)	0.77 (0.60 to 0.98)	

\*Based on multivariate log-binomial models, adjusted for smoking status, sex, age and educational level.  
PR, prevalence ratio.

### Attitudes towards outdoor smoke-free legislation

Our findings suggest that there is great support for outdoor smoke-free areas, support that is stronger among non-smokers than smokers. The highest support was for areas in which children are present (playgrounds and school/high school courtyards) and the grounds of healthcare centres. Moreover, more than half of the respondents supported smoke-free outdoor areas for public transportation (bus stops, stations), sport centres and university campuses. Less support was observed for smoke-free outdoor areas in shopping centres and swimming pools/beaches. A review of public attitudes towards smoke-free outdoor areas also found a majority support for restricting smoking in a variety of outdoor places that in general was higher for places in which children were present, ranging from 72% in a survey in Minnesota (USA) in 1998 to 91% in Californian (USA) and British surveys conducted in 2002 and 2007, respectively.<sup>14</sup> A study conducted in Italy revealed that 64.6% of Italians supported smoke-free policies in public parks, 68.5% in sports stadiums, 62.1% in beaches, 79.9% in outdoor areas surrounding hospitals, and 85.9% (the strongest support) in school courtyards.<sup>31</sup> In California,<sup>32</sup> a survey conducted in 2002 uncovered 91% support for smoke-free policies for children's play yards, 63% for outside buildings entrances and outdoor restaurant dining patios, 40% for outdoor bars/clubs, and 52% for outdoor public places including parks, beaches and sport stadiums. This support increased in the survey conducted in California in 2005.<sup>33</sup>

When we evaluated our results according to smoking status, we observed that non-smokers reported stronger support for smoke-free outdoor areas than smokers. These differences were consistently observed for all outdoor settings considered. The largest gaps between smokers and non-smokers occurred in support for sport centres (32.0% for smokers vs 62.4% for non-smokers) and swimming pools/beaches (21.4% for smokers vs 51.6% for non-smokers). The smallest gaps were in public parks (69.9% for smokers vs 84.9% for non-smokers) followed by school/high school courtyards (56.6% for smokers vs 76.1% for non-smokers) and the grounds of healthcare centres (57.9% for smokers vs 77.8% for non-smokers). Stronger support among non-smokers than smokers for restricting smoking in outdoor areas is consistent across countries.<sup>14 31</sup> However, more than half of the smokers interviewed here supported the restriction of smoking in outdoor areas where children are present (public park and school/high school courtyards) and the grounds of healthcare centres, as also reported in Italy<sup>31</sup> and New Zealand.<sup>31 34</sup>

### Policy and research implications

Outdoor smoke-free areas are not as common as indoor smoke-free areas. However, our study indicates that non-smokers reported SHS exposure in some outdoor settings, including outdoor areas at home, at education venues and during leisure time. A review of 18 studies of

SHS levels in outdoor areas reported mean PM<sub>2.5</sub> concentrations ranging from 8.32 to 124 µg/m<sup>3</sup> at hospitality venues and from 4.60 to 17.80 µg/m<sup>3</sup> in non-hospitality venues when smokers were present.<sup>35</sup> Although there is some controversy about the adverse health effects of SHS exposure in outdoor settings, several recent studies have reported evidence of the effects of short-term exposure to tobacco smoke, such as eye irritation and respiratory irritation in non-smokers<sup>36 37</sup> and even adverse effects on the cardiovascular system.<sup>38</sup>

The high percentage of non-smokers in the current investigation who reported SHS exposure at home and the percentage of smokers who reported smoking both indoors and outdoors at home highlight the need to develop health education interventions to implement voluntary smoke-free rules in those settings.<sup>8</sup> Previous studies demonstrated that restrictions at home are more common when smokers live with other non-smoking adults and where children are present.<sup>39</sup> In the current study, we were not able to determine whether the smokers who reported smoking at home lived with other non-smokers and/or children. Thus, promoting smoke-free homes should be a priority in our country, as an additional intervention for tobacco control, which is already done in other countries.<sup>9</sup>

The high percentage of non-smokers exposed to SHS in bars and restaurants is also of concern, as is our observation that more than half of the smokers reported smoking in those settings. A previous investigation of a sample of bars and restaurants in various European cities measured nicotine and particulate matter as SHS markers and detected significant SHS levels in outdoor areas, indicating a significant health risk for individuals exposed in those settings.<sup>40</sup> It would have been interesting to describe the support for prohibiting smoking in bars and restaurants outdoors, but we did not collect that information in this survey. Surveys in California (USA)<sup>33</sup> and New South Wales (Australia)<sup>41</sup> reported 72% and 69%, respectively, support for smoke-free outdoor restaurant patios. Terraces and patios will surely be the focus of new smoke-free legislation.<sup>26</sup>

The strong support for some outdoor smoke-free areas should be considered by policy makers and tobacco-control researchers for future interventions. This support indicates an important process of denormalisation of smoking, and policy makers should consider it to be a determinant for reinforcing tobacco-control measures. The strongest support for smoke-free outdoor settings was obtained for children's playgrounds, the grounds of healthcare centres, and school/high school courtyards. Those places were included in the last Spanish smoke-free law (Law 42/2010). It would have been interesting to compare the current results with data gathered prior to the implementation of Law 42/2010 in order to evaluate whether support for smoke-free areas changed after its implementation. Although we did not have those data, other studies suggest that support for smoke-free bans

increased after the adoption of legislation and over time.<sup>14 31</sup>

### Strengths and limitations

A potential limitation of the current study derives from the self-reported nature of the data obtained through questionnaires. This potential information bias was minimised by asking the participants for specific settings where they smoke and where they were exposed to SHS, and recording the participants' support for making specific outdoor places smoke-free on a five-point scale. This cross-sectional study included information obtained after the implementation of Spanish comprehensive smoke-free legislation (Law 42/2010). It would have been of great interest to have conducted a similar survey before that law, and also before and after previous legislation (Law 28/2010) to evaluate the effects of each law on tobacco consumption and SHS exposure in outdoor settings, as well as the changes in support for some smoke-free outdoor areas. Our previous survey (in 2004–2005, before Law 28/2005 was implemented) included information on smokers' consumption and SHS exposure in various settings.<sup>42 43</sup> However, we did not enquire separately about tobacco consumption and SHS exposure indoors and outdoors, nor did we investigate attitudes towards smoke-free outdoor places, as we did in the present study. It would also have been of great interest to collect information on SHS exposure and tobacco consumption in the outdoor settings that were regulated by the new law as we did for indoor public places. Future surveys should include that information to better describe and monitor the compliance and the effectiveness of the smoke-free policies in reducing SHS exposure.

### CONCLUSION

Our results show that the exposure of non-smokers to SHS mostly occurs in outdoor areas where smoking is allowed. The strong support for some smoke-free areas, including areas that are already smoke-free according to a national law, suggests the feasibility of extending smoking bans to several outdoor settings. Factors that influence support for smoke-free areas should be considered when deciding which policy interventions best promote the extension of smoking bans to outdoor settings. Awareness of the hazards of SHS exposure, the need to protect children and other non-smokers from this exposure, and/or establishing a positive model for youth should be on the agenda for interventions that favour the denormalisation of smoking and increased support for new smoke-free areas.

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